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Quantum Gravity and String Theory

Lecture Notes for Teaching Mechanistic Quantum Field Theory Axiomatically

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The purpose of these brief lecture notes is to provide the basic framework for a course in axiomatically-derived mechanistic quantum field theory, to teach the foundations needed to understand vixra paper 2606.0012. Problems and solutions will be developed for inclusion at a later date, after we have more experience in teaching this course to students.

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[v1] 2026-06-24 00:16:13

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Sorry, I made the following small LaTeX typesetting typing errors (which will be corrected in the revised notes at some later time when problems and solutions are included to turn it into a textbook): page 6, section 2.2:

both V(k) propagators are missing 4Pi, e.g. for massless propagator (Coulomb):

V(k) = 4Pi/k^2;

for massive propagator

V(k) = 4Pi/(k+m)^2.

However these examples are trivial and qualitative and in this kind of physics it is common to use a shorthand where all small dimensionless multipliers (like 2, 4 and Pi, etc) are ignored (i.e. set equal to unity). Similarly, at pages 7 and 15 in section 7.2, I've missed a factor of 1/2 from the Taylor expansion.

There's a more substantive by still not physically significant maths error on pages 9 and 31 in the Laplacian transformation: it should be done using integration by parts.

Let u = exp(-kr), so du = -k exp(-kr) dr, and dv = d(R^2 dV/dr)dr which yields v = (r^2)dV/dr. Then applying integration by parts ($\int u\,dv = uv - \int v\,du$), and using a negative Laplacian, we eventually end up with V(k) = 4Pi/(k^2 + m^2). Finally, Appendix G 1 should point out that

normalization of the four-velocity flips (u^μ)(u_μ) = -1, upon moving past the branch cut into the Lorentzian FLRW coordinate branch. What concerns me more is getting examples of practical calculations written down, e.g. the Lamb shift occurs very simply because of vacuum polarization and gauge boson aka "virtual" particle exchange:

The ~1 GHz Lamb shift, discovered in 1947 using the microwave frequency technology from radar invented in WWII, requires renormalizing the mass of the electron. Bethe was able to find an order-of-magnitude estimate of the lamb shift, namely E = [(4Z^4 α^5 m)/(3πn^3)][loge(Λ_{UV}/Λ_{IR})], where the logarithmic running of mass is included by using the ratio of the high energy cutoff, ΛUV, to the low energy cutoff ΛIR; the former (high energy or "ultra violet" aka UV cutoff) being the observed rest mass energy of the electron 511,000 eV, and the later the low energy or infrared (IR) cutoff equal to the

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